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FOOD COURT DESIGN FOR LARGE GROUP AUTO-SORT FOR GROW/FINISH PIGS

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Final Report

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Food Court Design for Large Group Auto-Sort for Grow/Finish Pigs

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Summary:

A series of trials were conducted to assess the productivity and behaviour of pigs housed in large-group auto-sort systems. The initial study was conducted at the PSC Elstow Research Farm and consisted of three rooms arranged as conventional small pens (18 pigs.pen), large group (250 pigs) auto-sort with feeders in the centre of the food court, and large group (250 pigs) auto-sort with feeders on the periphery of the food court. Over four replicates we were able to determine no differences in average daily gain among the treatments, although large-group auto-sort pens emptied more slowly in the later part of the marketing period. The carcass index did not differ among the treatments, but pigs from the central food court treatment were slightly fatter than pigs from the small group rooms. A high incidence of circo-virus was present during these trials but did not appear to affect treatments differentially. Pigs in conventional small groups had a higher incidence of tail-biting than did the large groups, but large group rooms had a slightly higher incidence of non-thrifty pigs (excluding circo-virus), perhaps due to initial failure to learn the system. Pigs in both food-court arrangements had similar numbers of meals each day, used the feeders within the food court evenly, and evidenced a typical crepuscular (lights on/lights off) feeding pattern. Neither food court configuration had obvious advantages over the other, and both resulted in acceptable productivity. Large groups had much lower levels of tail-biting than did conventional small pens.

The second study consisted of operating the large-group auto-sort pens as a market-sort system in which pigs were moved from conventional small pens to large group auto-sort within 1-3 weeks of their expected marketing. Pigs were allowed free access to the food-court for 48 hours before a 24 hour sort. At the end of the 24 hr sort there were 12-20% of the pigs that had not passed through the scale. These were easily herded through the sorter in 20 minutes. The market sort system has potential for operations with a limited numbers of sorters.

The third study was conducted on a commercial farm that housed its grower/finisher pigs in large group auto-sort rooms, with groups of 650 pigs. Average daily gain within this barn averaged 899 gm/day, which is considered quite good within the industry. Pigs averaged between 2.6 and 4.2 entrances into the food court each day, with higher levels being common during the initial two weeks in the system. The pattern of entrances into the food court evidenced a weak crepuscular pattern, and many pigs were observed lying within the food court. Eating patterns were distinctly crepuscular in nature, as would be expected in grower/finisher pigs. However, the younger groups of pigs had higher mid-day eating levels, indicative of feeder restriction, but unlikely to reduce productivity at the level observed. The behaviour and productivity recorded on this operation supports the use of auto-sort systems for groups of 650 pigs.

Introduction:

As late as 1988 (English et al., 1988) the pig industry was discouraged from using large groups of pigs because of anticipated social problems. However, the industry recognized that large groups could reduce a variety of production costs and research was encouraged. We have been engaged in research on large groups (without auto sort) for five years. Our findings were that the social behaviour of pigs changes markedly in groups of 100 or more pigs (Turner and Edwards, 2004; Samarakone and Gonyou, 2009) and the cautions previously in place have been discounted. In fact, productivity in large groups is generally equal to that in small conventional pens with the exception of the initial two weeks after group formation (Wolter and Ellis, 2002; Street and Gonyou, 2008; Samarakone and Gonyou, 2008).

One of the potential advantages of large groups is that they allow the adaptation of new technology that would be too expensive when applied to small groups of pigs. One such technology is in-pen scales that would sort pigs by weight for market or phase feeding control (weight based diet formulation). It has been estimated that the ability to sort pigs within their pen has the potential of returning $5-15/pig depending on whether only marketing or marketing and feed control were implemented. Large Group Auto Sort (LGAS) has been implemented on a number of farms, but reports of reduced rates of gain are common and some operations have reverted to conventional small pens.

Many of these reports of decreased rates of gain can be attributed to poor feed court design. Most LGAS systems require pigs to pass through the scale as they move from the loafing area into the 'food court'. After eating they return to the loafing area via one-way gates. Some of the issues arising with food court design are the availability and access to feeding spaces, and the ability of pigs to learn the appropriate traffic flow pattern through the scale and out the one-way gates. Common food court problems are too few feeders, or feeder spaces that are blocked by pig traffic or pigs lying in the food court. Our hypothesis is that lying in the food court is encouraged by the most common design, that of centrally placed feeders. This leaves pigs access to wall space in the food court that is ideal for lying. However, the presence of these pigs then restricts access to feeders.

Little is known about the feeding patterns of individual pigs in LGAS systems. Pigs typically eat 10-20 meals a day in conventional small groups, but in LGAS systems

the overall average is 3-4 entrances per day into the food court. Pigs may be combining several meals into one visit to the court, or simply eating fewer meals.

The objectives of this study were to study the production and behaviour of pigs in conventional and large group auto-sort systems, including two food-court designs. The specific objectives within these two general objectives had to be modified due to the closure of the initial research facility during the study. However, the first two general objectives were maintained:

1. Production comparison of conventional and large group auto-sort management.
2. Behavioural analysis of the auto-sort system.

A third objective relating to correlations between production and behaviour variables could not be achieved due to technical problems.

Methods:

Study I

The project was initiated at the PSC Elstow Research Farm, a 600 sow farrow-to-finish facility. Three rooms within the grow/finish wing were adapted for the study. A Conventional room was maintained as a 16 pen, 2 feeder-spaces per pen, standard grow-finish room. Up to 18 pigs could be housed per pen. Whenever possible, two pens were maintained as relief pens for compromised animals. The other two rooms were modified for large-group auto-sort management. The basic design of the room consisted of a large loafing area, a food court, and two conventional sized relief pens. The food courts comprised approximately 30% of the area available to pigs in large groups. Each food court was accessed through an auto-sort scale (Sierens Equipment, Manitoba). One food court was designed with the feeders lined up down the centre of the pen (Centre), while the other had the feeders on the walls of the court (Peripheral), but each provided 24 feeders space in total. See Figure 1a and 1b.

Rooms were filled over a three week period, with each room receiving most of the pigs from a single weaning cohort. When the three cohorts differed substantially in numbers of pigs, some transfers were made to yield similar numbers of pigs in each room. Pigs were 10 weeks of age when moved to the experimental rooms. Pigs were weighed in pen groups as they were moved from the nursery to the grow/finish wing. Pigs were fed ad libitum standard grow/finish diets in a phase feeding system. Pigs in the Conventional room were weighed at 3-wk intervals using a hallway scale. Weights for pigs in the auto-sort rooms were obtained from the scale records (average of all weights for the day). Pigs were marketed as they reached target weight which fluctuated with the market conditions.

The initial 'fill' of the rooms was used to standardize management of the auto-sort rooms. The resulting protocol involved placing feed and water in the bottom of all wet-dry feeders and running pigs into the food court. All passages between the food court and loafing area were then left open for the pigs to explore their new surroundings, but only after they had been exposed to their food and water source. Once a week for the following three weeks the auto-sort scale was activated for 24 hours and pigs had to enter the food court through the

sorter. Pigs were spray painted as they crossed the scale to identify those that had entered the food court. Weekly weighings were scheduled through marketing, but technical problems arose and data proved to be unreliable throughout much of the trial. Data from the scale were used to determine diurnal patterns of food court entries. All pigs were sorted for market by the sorters.

Time-lapse cameras were mounted over the feeders in the food courts and set to shoot photos at 5 min intervals in order to establish feeder use patterns. Ten pigs in each room were painted prior to this photo session to allow us to record their individual eating patterns.

Problems Encountered: Three major problems occurred during the study that limited the amount of data collected. Circovirus was evident in all replicates, and was unevenly distributed among the weaning cohort groups. Large numbers of pigs had to be euthanized due to this disease. At the time of the study a vaccine had not yet been developed for this disease. Secondly, the feed delivery systems in all rooms proved to be unreliable. This was traced to an infestation of the feed by insects in the feedmill. Collecting valid feed intake data, as originally planned, was not possible. The third problem was that one sorter proved to have a wiring malfunction that caused frequent failure. As a result, the second fill provided little data and the 3rd and 4th fills were useful but still incomplete.

Closure of PSC Elstow Research Farm: This experiment was conducted during a period of depressed prices and high feed costs. Unable to obtain sufficient additional funding to continue, it was necessary to suspend operations at the facility. Consequently, the study had to be shut down over a period of three months, and before sufficient replicates of the study could be completed. Unable to complete another fill of all pens, we modified our protocol to assess a market-sort only use of the rooms.

Study II

Market-Sort Application: The two auto-sort rooms were operated as market-sort pens for six weeks at the conclusion of the Elstow study. During this period approximately 125 pigs within 3 weeks of marketing were added to each room weekly. The average number of pigs in the room (including pigs from previous weeks) averaged 191, with a range of 116 to 268. The sorter and all one-way gates were left in the open position for 48 hours to allow pigs to freely move between the food court and loafing area. The auto-sort was then activated and pigs were confined to the centre portion of the loafing area. Their only exit was through the scale. Once through the scale they were sorted by weight into markets and lights. Sorted pigs had access to the ends of the loafing area as well as the food court. The pigs that had not sorted after 24 hours were forced through the scale. This system of using auto-sort facilities is practiced on some commercial farms to avoid the cost of equipping every room with a scale.

Study III

Commercial Farm: With the complete closure of the PSC Elstow facilities we arranged to collect additional data on a commercial farm using the same auto-sort equipment. However, it was not possible to impose different food court designs or to maintain a Conventional treatment.

Observations were conducted on a commercial farm (Rolling Acres Colony, Manitoba) which operated 10 auto-sort rooms. Each room was equipped with a three-way sorter, a three cell food court, and a large loafing area (Figure 8). There were 60 feeder spaces within the food courts. An additional 4 nursery rooms were used and served to train the pigs to the room layout. Nursery rooms were identical to sorting rooms but did not have a sorter. Records from the auto-sort scales were cleaned to account for hits that involved multiple pigs (overweight hits), to yield both average pig weight and average number of pig entrances per hour. Data were collected on four rooms of pigs, at two week intervals, up to the point that pigs began to be marketed. The data were analysed for average daily gain, average number of pig entrances per day, and the diurnal pattern of pig entrances.

A 24-hr observation was conducted on four rooms of pigs. The rooms selected were 2 weeks apart in age, giving a span of 6 weeks among the rooms. Two areas within each room were observed: a defined portion of the food court, and a defined portion of the loafing area. The number of pigs engaged in the activities of eating, standing, and lying in each area was recorded. Data were analysed for diurnal patterns of each behaviour.

Results:

Objective 1. Performance

Elstow Study:

Limited production data could be obtained from the four replicates completed. Comparable growth data was obtained for the Conventional small group and Centre large group treatments for one replication (Figure 2.) No difference in the pattern of weight gain was seen between treatments. Although regular weighings could not be conducted as planned with the faulty scales, we were able to sort all pigs at market and we tracked the cumulative percentage of pigs marketed for weeks 10-13 for all treatments. There was no difference between the Centre and Peripheral treatments for the pattern of marketings, so their data were combined for the comparison of Conventional with Large Group in Figure 3. Marketings were similar through week 12 when nearly 50% of all pigs had reached market weight. During the subsequent week more pigs were marketed from the Conventional small group treatment ($P<0.01$). Some, but not all, producers using auto-sort technology have reported poor gains compared to conventional systems. In same cases the problems were corrected by providing better access to feeders within the food court. Both food courts in this study were spacious and designed to provide adequate numbers of feeder spaces (1 per 9

pigs). Growth appeared unaffected by the system except that marketing rate decreased in the final stages. It would appear that many pigs grow normally, but a few were slower to reach market weight.

Carcass data were obtained for two replications. Pigs were classified by carcass weight into ranges of 81.5-86.49, 8.5-91.49, 91.5-96.49 and 96.5 – 101.49 kg. Pigs falling outside of these ranges and those with incomplete data were excluded from the analysis, leaving 592 pigs whose data were analysed for treatment, gender and carcass weight class effects. Treatment did not affect either the carcass index score nor the cross-sectional area of the loin muscle. Pigs from the Centre large group configuration were fatter and had a lower lean carcass % than did pigs from Conventional small groups ($P<0.05$), but the Peripheral treatment was intermediate to the others (Table 1). The fact that carcass index scores did not differ indicates that the value of carcasses falling within the normal grid did not differ between systems. Greater fat depth has been reported in some studies, and it has been suggested that eating patterns, specifically fewer and larger meals, may contribute to greater fat deposition (Morrison et al., 2003). However, it proved to be insignificant in terms of carcass index.

Pigs were removed from the study if they required social relief (damaged by other pigs), medical treatment, or euthanasia (Table 2). The proportion of pigs removed for each condition did not differ between the two large group treatments. More pigs were removed from the small group treatment due to tail bites than from the large groups (18 vs. 1%; $P<0.01$), but more were removed from large groups for 'other' reasons (generally unthriftyness) than from small groups (8.5 vs. 3.9%; $P<0.01$). Although severe tail biting has been suggested to be more likely in large groups due to social facilitation, this has not been the case in our earlier study of large groups and quite the opposite was seen in this auto-sort study. Although the entire farm was experiencing high levels of tail biting during this study, the exception was the auto-sort system which had very low levels. It appears that pigs are able to escape from others intent on tail biting in this situation. The slightly higher incidence of unthrifty pigs in the auto sort pens may be due to a few pigs failing to adapt to the sorter system. These pigs likely contributed to the delayed marketing of animals in the later stages of marketing. We noted that the entrance gates would close tightly around some pigs as they entered the scales and this may have discouraged them from re-entering the scale. We hypothesized that the air pressure being used was too great, and reduced this in subsequent replicates. In general, health problems were different in the conventional and large group pens, and we anticipate management could improve the large group results.

Commercial Farm:

Although it was not possible to compare average daily gain between two treatments, four rooms were monitored from entrance into the auto-sort until first marketing. The pens averaged 899 g/day, and ranged from 855 to 963 g/day. These levels of performance are quite acceptable on a commercial farm and indicate that the auto-sort arrangement with 650 pigs/room was working well.

Objective 2. Behaviour

Elstow Study:

The relative number of 'hits', or recorded entrances, into the Peripheral treatment sorter per hour at two week intervals is presented in Figure 4. Although a diurnal pattern is evident with more entrances during the photophase (daytime), the pattern was not as distinct as typically reported for eating patterns of pigs in conventional pens. Analysis of the individual entrance records indicated that a large number of the recorded weights fell above the expected curve (Figure 5a). These were judged to be cases of two pigs entering and being weighed at once. The incidence of these double entrances decreased as pigs grew, with very few evident when pigs averaged 78 kg or higher (Figure 5b). When the number of entrances was adjusted for these multiple entries, the diurnal pattern of entrances evidenced a more typical diurnal pattern (Figure 6). These multiple hits would result in inaccurate weight estimates if included in the summary of data. Although we compensated for this by 'cleaning' the data manually, the scale manufacturer has modified their software to do so as well. However, care must be taken to ensure that the average weight and weight variation obtained from scale software is accurate.

The proportion of eating that occurred at each bank of feeders is presented in Figures 1a and 1b. Within the Centre configured large group pen the pigs tended to avoid the feeders set on the end walls, adjacent to another pen. Within the Peripheral arrangement, the feeders adjacent to the loafing pen were underutilized. Otherwise, use of the feeder spaces was well balanced. The diurnal distribution of pigs eating within the food courts is presented in Figure 7a and 7b. Both food court configurations evidence a distinct crepuscular pattern, with reduced eating during the night and a short mid-day reduction as well. The even distribution of feeder use indicates that the food courts were spacious enough to not hinder use of the feeder spaces. The diurnal pattern indicates that feeder space was adequate for the number of pigs being fed.

The individually identified pigs in both food court configurations were assessed for their eating behaviour. Both groups had similar numbers of meals in a day. The Centre configured court resulted in a greater total duration of eating. Pigs in both configurations typically sampled from more than 5 feeders each day. This confirms earlier studies we have conducted that indicate that individual pigs do not restrict themselves to a specific feeder space within a pen.

Market-Sort:

During the market-sort phase of the study new pigs were added to each auto-sort room on a weekly basis. After 48 hours of free access between the food-court and the loafing area, the sorting system was activated. The proportion of pigs failing to pass through the scale after 24 hours averaged 16%, with a range of 12 to 20%. These pigs could generally be herded through the scale in less than 20 minutes. In general, older pigs find it more difficult to adapt to a new system than do pigs that are introduced to it early in life. The danger of pigs failing

to adjust to the auto-sort when introduced at near market weights was evident in this study, but not as severe as anticipated. The auto-sort system was capable of being used as a market-sort system provided management included a forced sort within 24 hours of operation. The forced sort was quite manageable as less than 20% of the pigs were involved.

Commercial Farm:

The average number of pig entrances per day were determined for four rooms when average weight ranged from 40 to 100 kg (Figure 9). The number of entrances per pig ranged from 2.6 to 4.2 per day. There was considerable variation among rooms within a weight category, but in general, the number of entrances was highest at first and decreased after the initial 2-3 weeks in the system. Thus pigs were able to obtain several meals each day. It is unclear if each entrance represented a single meal, or if pigs rested within the food court between meals. The production results would indicate that 2.6 to 4.2 entrances per day are adequate to achieve good growth.

The number of pigs passing through the sorter each hour was expressed as a ratio between observed (actual numbers) and expected ($1/24^{th}$ of daily entrances). The resulting diurnal patterns, obtained over several weeks, are presented in Figure 10. Hourly ratios varied from approximately 0.10 to 2.00, although most fell within the range of .5 to 1.5. The diurnal pattern reflected a period of few entrances during the night, and increased entrances during the illuminated period of the day. Some evidence of a crepuscular cycle, with peaks at 'lights on' and 'lights off', was evident. A clear crepuscular pattern is indicative of a normal eating pattern. Lack of a crepuscular pattern would suggest that access to feed is restricted and competition is excessive. Entrance pattern, which can easily be obtained from the auto-sort records, would be less definitive of eating patterns than would those obtained by observing eating behaviour itself.

Data from the 24-hour observation were summarized into 3-hr periods, starting with midnight-03:00 hr. Although observations were restricted to defined (visible) portions of the loafing area and food court, the pattern of behaviour within each zone was expected to yield a representative sample of the entire area. Within the loafing area, the diurnal pattern of active behaviour (Figure 11) reflects a crepuscular activity pattern as expected. Pigs evidenced two major periods of activity, in the morning and evening. Although a disturbance affected behaviour in the oldest room during the morning, the daily pattern remained typical. Within the food court, a similar pattern of active behaviour was observed (Figure 12).

Eating behaviour within the food court demonstrated a crepuscular pattern (Figure 13). All ages of pigs had a similar pattern of eating in the morning, but during the middle of the day and evening, younger pigs spent more time eating and the evening peak was less distinct. Such a pattern reflects that seen in pigs that are somewhat restricted in terms of feeder space (Walker, 1991). Younger pigs spend more time eating than older pigs, and must shift their eating patterns to mid-day if feeding space is limited. If the restriction is severe, the nocturnal period includes a much higher level of feeding as well. This study provided one feeder space for every 11 pigs in the room. The patterns observed suggest that the younger

pigs were mildly restricted in terms of access to feeder space, but this level of restriction would be unlikely to reduce performance.

Conclusions and Recommendations:

1. Auto-sort technology can be used successfully with growing/finishing pigs with only minor, if any, impact on productivity. We would recommend the following management protocols:
    a. Have spacious food courts with at least 1 feeder space for every 10 pigs.
    b. Introduce pigs directly into the food court to familiarize them with their source of food and water.
    c. Set the scale for 'soft' closures to avoid causing fear of the sorter.
    d. Observe pigs closely and remove 'unthrifty' pigs to recovery pens.
2. Tail biting is reduced in auto-sort systems.
3. Carcass quality is only mildly affected by auto-sort systems. Assuming that the increased fat deposition is due to fewer meals, we would recommend that entries per day be monitored and kept at between 3 and 5 per day.
4. Auto-sort systems can be used as a 'market-sort' system, but producers should expect up to 20% of pigs would fail to pass through the scale within 24 hours after sorting begins. Therefore provision must be made to force sort these pigs in a reasonable time (perhaps after 16 hours).
5. With spacious food courts pigs will make good use of all feeding spaces. If productivity is poor, we recommend that diurnal behaviour patterns be assessed to identify the source of the problems.

Acknowledgements:

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We thank Sierens Equipment of Manitoba for their technical support throughout the study and for identifying a commercial farm on which to continue the research.

We thank Rolling Acres Colony of Manitoba for allowing us to gather data on their operation.

We thank the various research assistants, technicians, graduate students and farm staff involved in data collection and analysis.

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Other:

Presentations:

Presentations on the use of large groups and large group auto-sort have been made in Alberta, Saskatchewan, Manitoba, Ontario and the United States. Numerous requests for advice on large group auto-sort from these same regions have been answered. We have provided advice to Sierens Equipment concerning potential improvements to their sorter technology and software, and have benefitted from their advice on management of the system.

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Ms. Ashley Shannon, Technician
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Expenditures:

Respectfully submitted,

Harold Gonyou

Table 1: Effects of housing treatment, carcass weight class, and gender on carcass traits (LS means and significance values)

Item	Treatment*			Weight**				Gender		P value***			
	Conventional	Centre	Peripheral	1	2	3	4	gilts	barrows	T	W	G	
Index	109.78	109.33	109.46	107.24[a]	110.23[b]	110.55[b]	110.08[b]	110.60	108.45	.105	**<.001**	**<.001**	
OR%	61.33[b]	60.73[a]	61.03[ab]	61.30	61.07	60.91	60.83	61.84	60.22	**.001**	.381	**<.001**	
Fat	16.91[a]	18.24[b]	17.48[ab]	16.58[a]	17.27[ab]	17.95[bc]	18.37[c]	15.74	19.35	**<.001**	**.019**	**<.001**	
Lean	61.22	61.19	60.39	58.28[a]	59.94[a]	61.91[b]	63.60[c]	62.48	59.38	.387	**<.001**	**<.001**	

**Weight: Liveweight at slaughter, in kg. Categories: 1) 81.5-86.49, 2) 86.5-91.49, 3) 91.5-96.49, 4) 96.5-101.49.
***P values: Type III sum of squares from GLM analysis.

Interaction effects: Two and 3-way interactions of treatment, weight class and gender were tested. None was significant.

Table 2: Pigs from small and large group treatments removed from study for lameness, tail bitten, circovirus and other reasons

	Lame	Tail Bitten	Circovirus	Other	Not removed		
Conventional (small group)	18	99	23	21	375		P <.01
Centre (large group)	28	6	11	49	418	ns	
Peripheral (large group)	21	4	7	39	447		

Table 3. Eating characteristics of pigs in Centre configured food courts, and Peripheral configured food courts.

Room	Average number of meals	Average total time feeding (min)	Min/ meal	# of Feeders
Centred	5.0	58.33	11.7	5.6
Peripheral	4.7	44.55	9.4	5.5

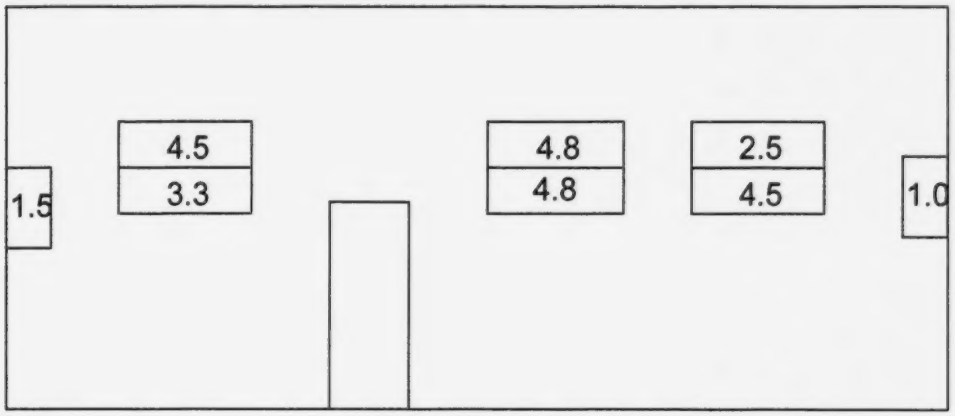

Figure 1a. Food court with feeders located in the Centre of the court. Banks of feeders consisted of 2 or 4 spaces each. Values in each bank indicate the average percentage of feeding time spent in each f the spaces within that bank.

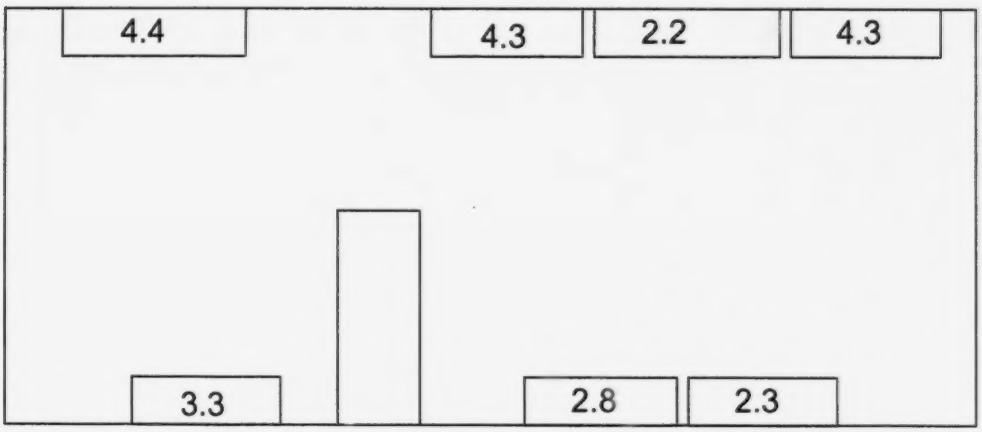

Figure 1b. Peripheral food court with feeders located along the walls of the court. Banks of feeders consisted of 4 or 5 spaces each. Values in each bank indicate the average percentage of feeding time spent in each of the spaces within that bank.

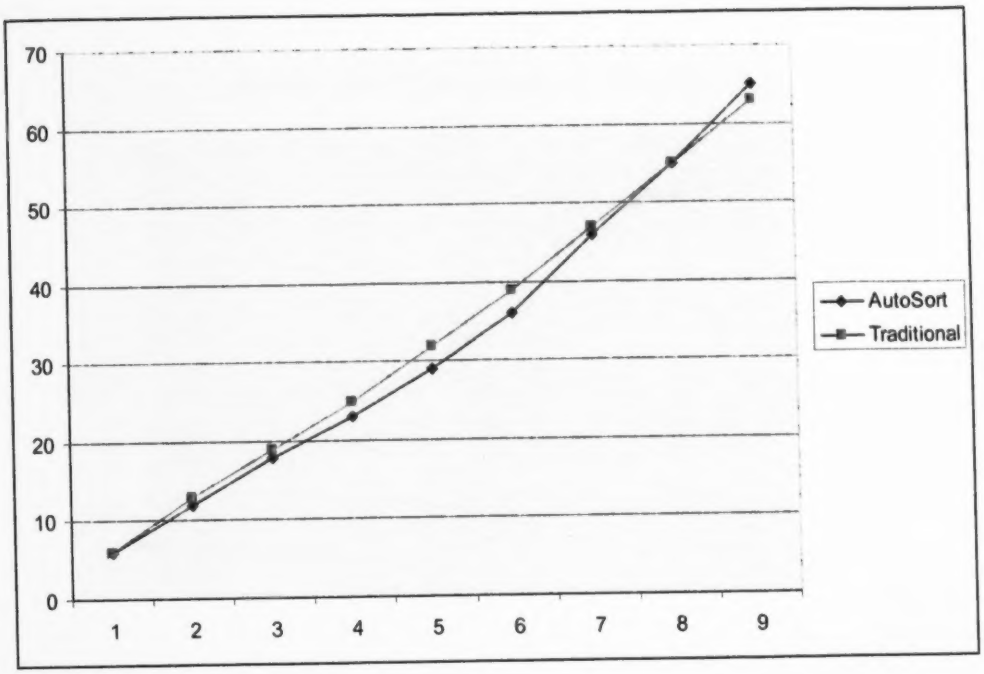

Figure 2. Accumulated gain (kg) of pigs in the Conventional small pen and Centre configured large group treatments over the first nine weeks of treatment.

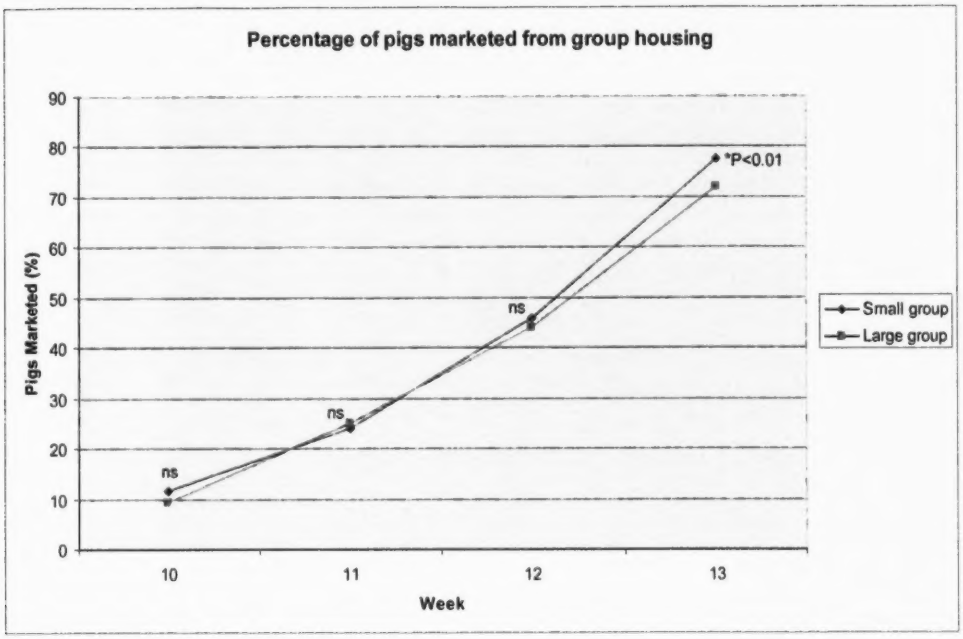

Figure 3. Cumulative percentage of pigs marketed from conventional small groups and large group auto-sort after 10-13 weeks in the finisher rooms. ns no significant difference between treatments. * difference at P<0.05.

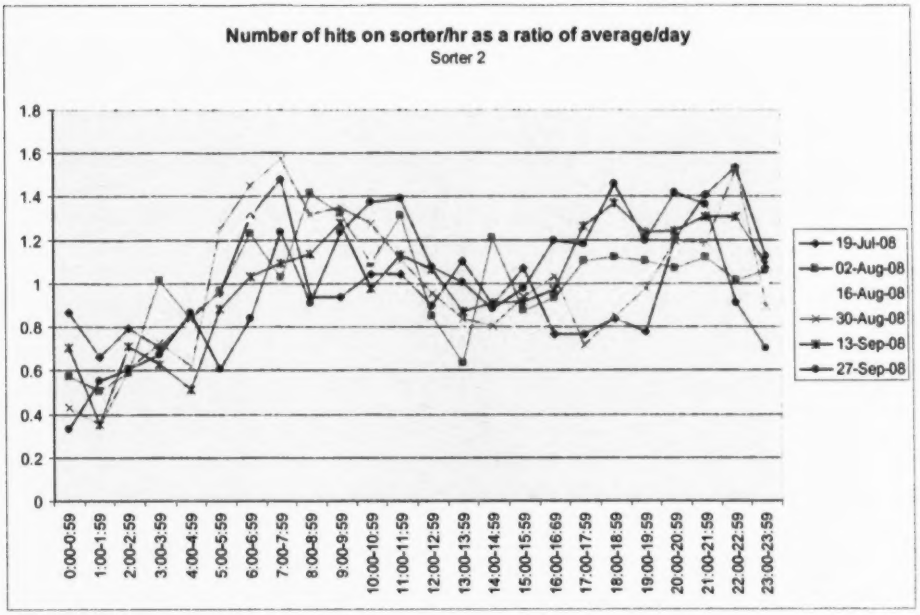

Figure 4. Diurnal pattern of 'hits' or entrances into the sorter over several weeks. Values have been adjusted to the ratio of observed/expected, with expected based on 1/24th of total.

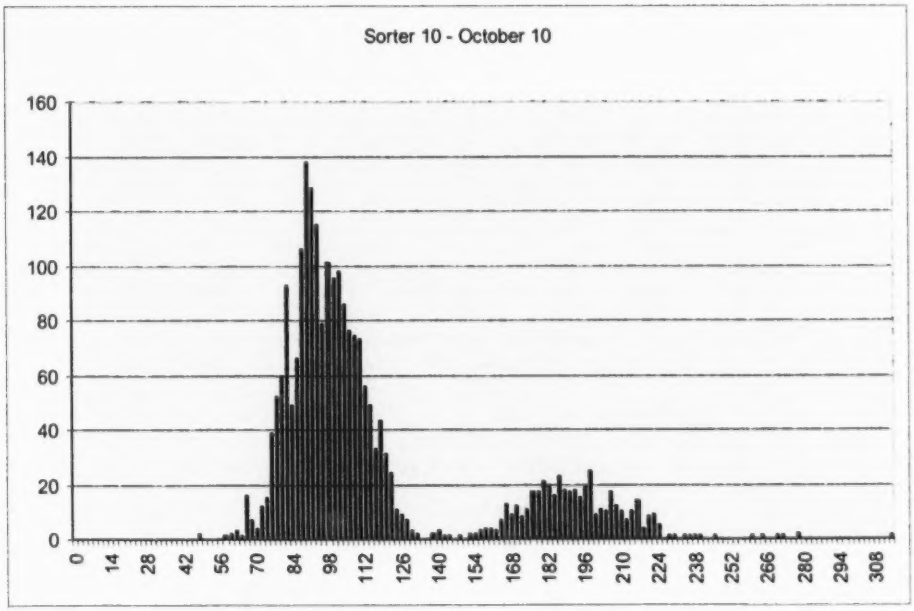

Figure 5a. Distribution of weights recorded by sorter during period when pigs averaged approximately 45 kg (98 lbs). Second cluster to right represents times when two pigs were in the scale. Weights in lbs.

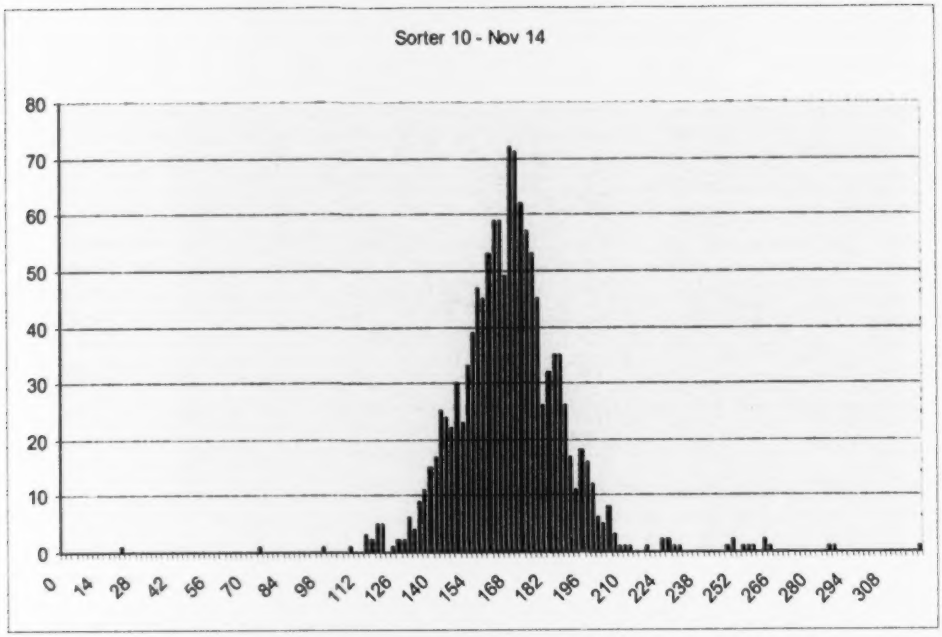

Figure 5b. Distribution of weights recorded by sorter during period when pigs averaged approximately 77 kg (170 lbs). No secondary cluster of weights is evident. Weights in lbs.

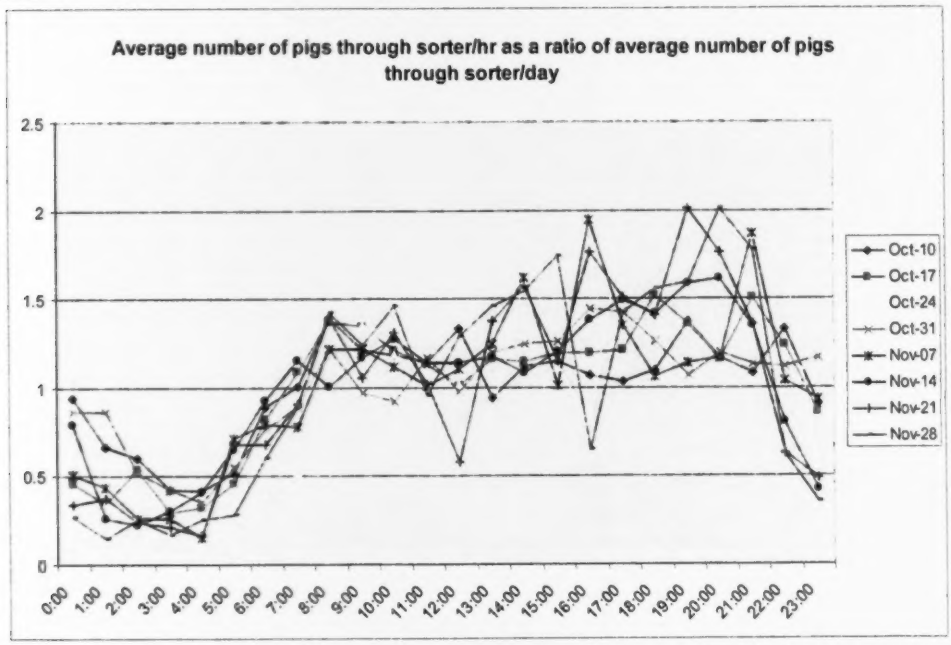

Figure 6. Diurnal pattern of pigs entering the sorter after correction for double entrances. Values have been adjusted to the ratio of observed/expected, with expected based on $1/24^{th}$ of total.

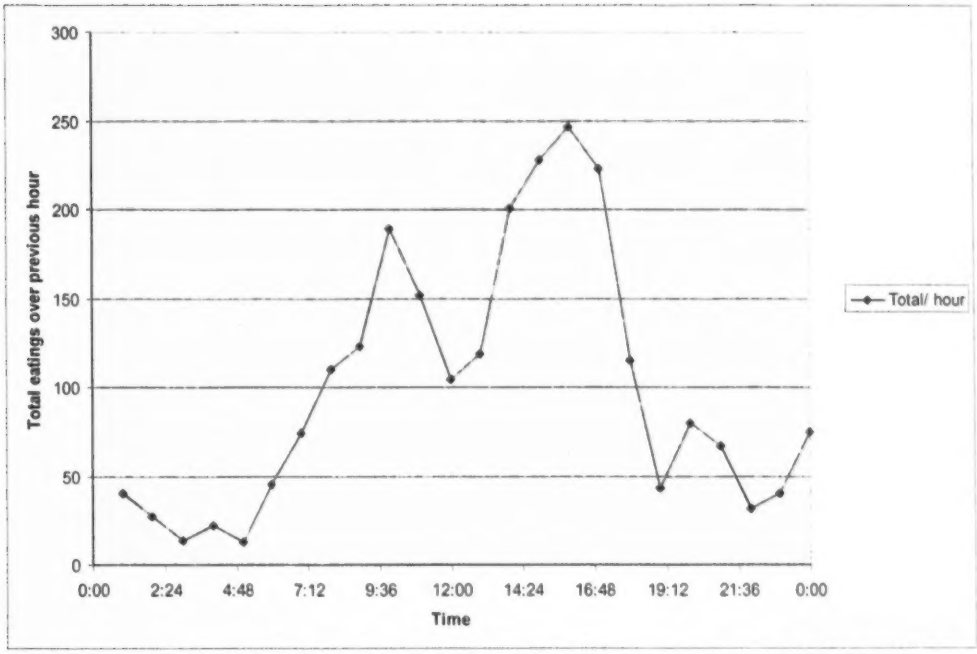

Figure 7a. Diurnal distribution of pigs eating in the Centre configured food court.

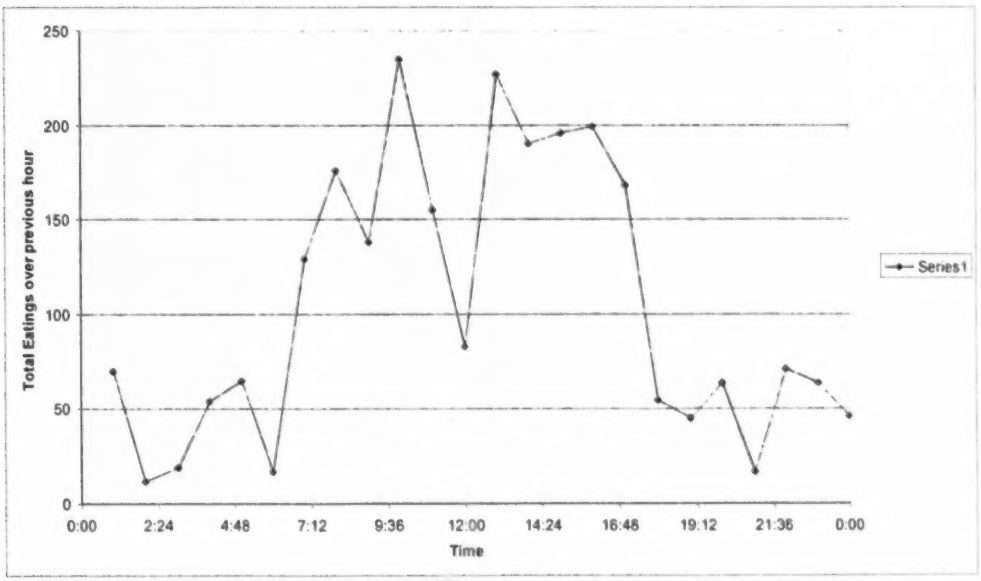

Figure 7b. Diurnal distribution of pigs eating in the Peripheral configured food court.

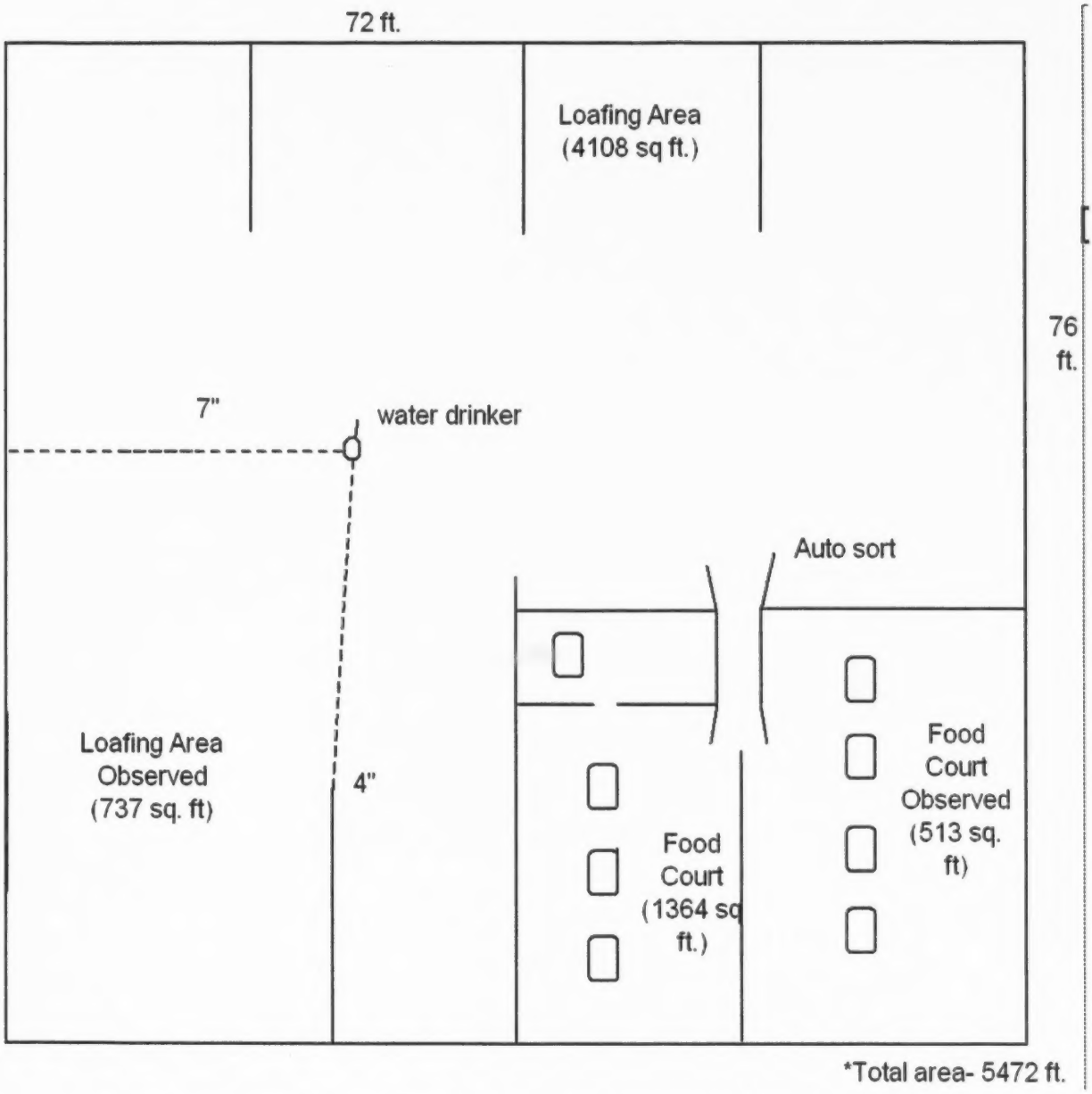

Figure 8. Auto-sort room on commercial farm. Total area was 511 sqm. Food court was 127 sqm. Loafing area was 384 sqm. The room housed 650 grow/finish pigs.

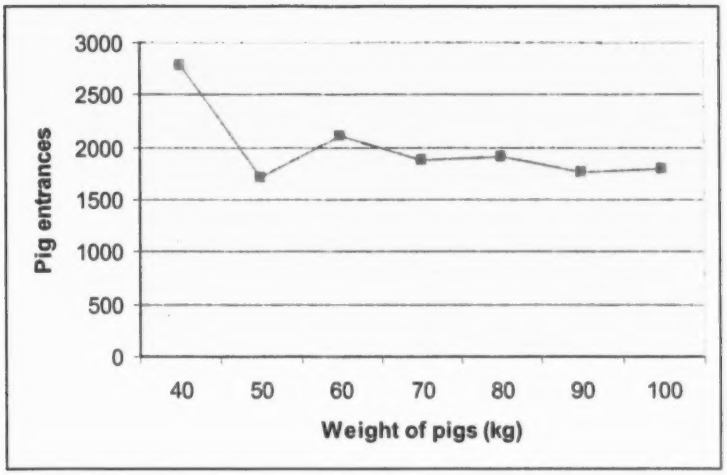

Figure 9: Average number of pig entrances per day throughout the grow/finish period for pigs in an auto-sort pen. Represents four rooms, each with 650 pigs. Adjusted for multiple entries per 'hit'.

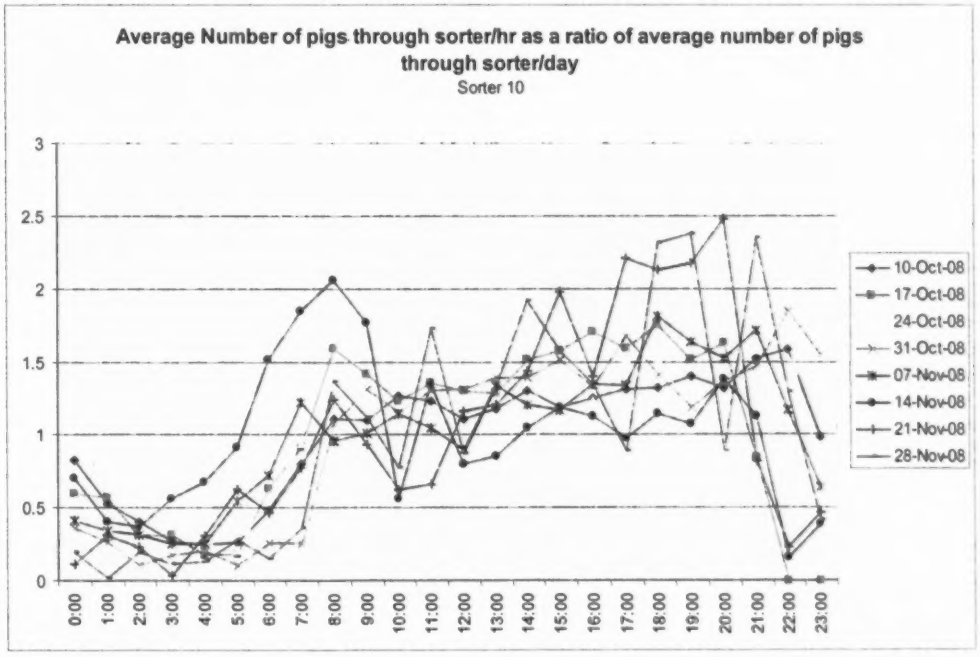

Figure 10: Number of pigs through the sorter per hour expressed as a ratio with average number per hour for that day, over several weeks.

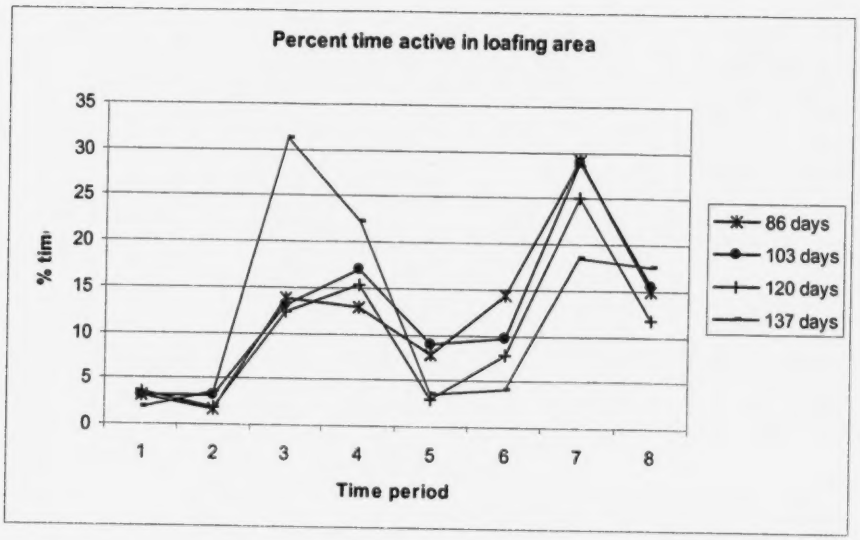

Figure 11: Activity pattern of pigs in the loafing area of auto-sort rooms with different aged pigs. The day was divided into eight 3-hr periods, starting at midnight.

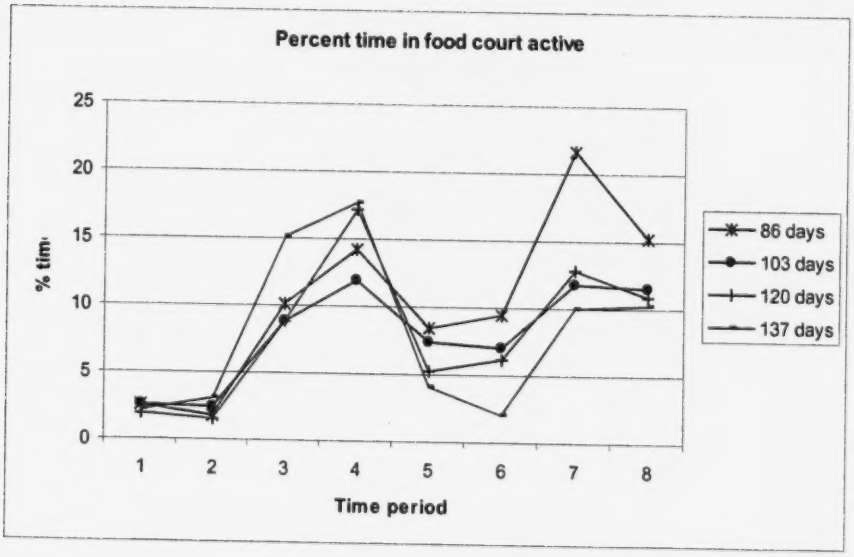

Figure 12: Pattern of active behaviour among pigs within the food court of auto-sort rooms with different aged pigs. The day was divided into eight 3-hr periods, starting at midnight.

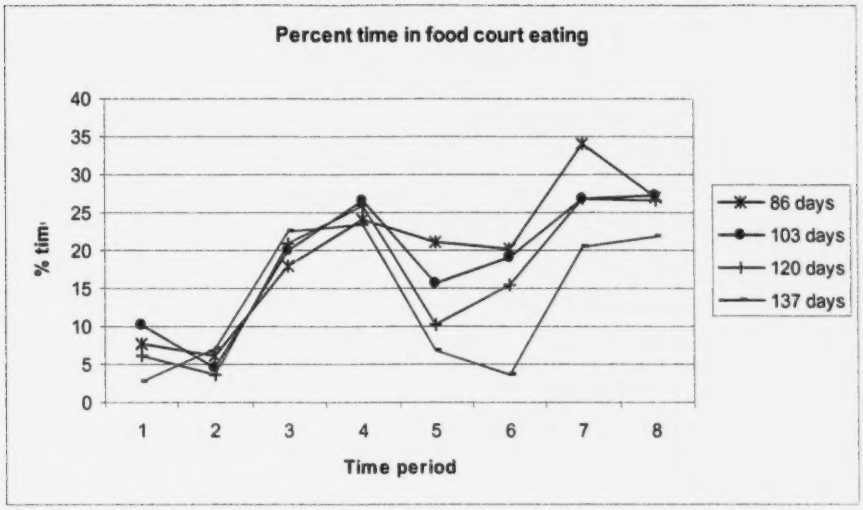

Figure 13: Diurnal pattern of eating by pigs within the food court in auto-sort rooms with different aged pigs. The day was divided into eight 3-hr periods, starting at midnight.